

**TPF/Darwin
Talk
Evolution of Stars and Habitability - 2**

Contrib

Abstract

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**Energy Deposition by Solar Energetic Particles in the Upper Atmospheres of
Venus-like Extrasolar Planets**

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The structure, dynamics, chemistry, and evolution of planetary atmospheres are in large part determined by the available sources of energy. One potentially important energy source is solar energetic particle (SEP) events consisting of large fluxes of charged particles accelerated near the Sun during and following fast coronal mass ejections. While other mechanisms provide more constant sources of energy, SEP events can significantly affect an atmosphere for short periods, possibly enhancing atmospheric loss and driving chemical reactions. At unmagnetized planets, in particular, SEPs of all energies have direct access to the atmosphere and so provide a more substantial energy source than at planets having protective global magnetic fields. SEP-related atmospheric energy input should be more significant for planets orbiting more active stars. Therefore quantification of the atmospheric energy input from SEP events is an important component of our understanding of the processes that control their state and evolution. Here we present the results of an initial calculation of the energy input by a single large SEP event in a Venus-like CO₂ atmosphere. We calculate the penetration depth and energy deposition profile of energetic protons having different incident energies, and weight the profiles by the event-integrated energy spectrum of a SEP event to calculate the total energy deposition. We compare to the energy deposited by photons and discuss the potential role of SEP events on extrasolar planetary atmospheres.